

WHAT IS CLAIMED IS:

1. A semiconductor optical device comprising of:
a first conductive semiconductor substrate;
5 a semiconductor optical amplifier formed on the semiconductor substrate so as to have a horizontal-direction lasing structure; and
a first and a second photo detector formed respectively at positions of the semiconductor substrate spaced horizontally from an input side and an output side of the semiconductor optical amplifier so as to measure intensities of an input signal and an output
10 signal of the semiconductor optical amplifier.

2. The semiconductor optical device as claimed in claim 1, wherein the semiconductor optical amplifier includes a ridge waveguide-type semiconductor optical amplifier.
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3. The semiconductor optical device of claim 2, further including a current blocking layer that comprises two p-InP layers and an n-InP layer.
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4. The semiconductor optical device as claimed in claim 2, wherein the semiconductor optical amplifier comprises:

a Bragg lattice formed selectively on a portion of the semiconductor substrate except for a predetermined gain layer area;

5 a first conductive lower clad layer formed on and co-extensively with an upper surface of the semiconductor substrate so as to surround the Bragg lattice;

an optical waveguide layer formed on the lower clad layer;

a first conductive upper clad layer formed on the optical waveguide layer;

a gain layer formed on a portion of the first conductive upper clad layer that
10 corresponds to the predetermined gain layer area in order to amplify an optical signal;

a first electrode for supplying current to the gain layer; and

a current blocking layer for preventing current from flowing to any area except the gain layer.

15 5. The semiconductor optical device as claimed in claim 4, wherein the first and the second photo detectors are respectively formed on portions of the first conductive upper clad layer horizontally spaced from an input side and an output side of the semiconductor optical amplifier.

6. The semiconductor optical device as claimed in claim 5, wherein each of the first and the second photo detectors comprises:

- an active layer including a material the same as that of the gain layer;
- a second conductive clad layer formed on the active layer; and
- 5 a second electrode formed on the second conductive clad layer.

7. The semiconductor optical device as claimed in claim 4, wherein each of the first and the second photo detectors comprises:

- an active layer including a material the same as that of the gain layer;
- 10 a second conductive clad layer formed on the active layer; and
- a second electrode formed on the second conductive clad layer.

8. The semiconductor optical device as claimed in claim 7, wherein the optical waveguide layer is formed above or below the Bragg lattice.

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9. The semiconductor optical device as claimed in claim 4, further comprising a phase conversion area formed between lattices of the Bragg lattice.

10. The semiconductor optical device as claimed in claim 9, further comprising
20 a phase conversion electrode for supplying current to the phase conversion area.

11. The semiconductor optical device as claimed in claim 10, wherein the phase conversion electrode is disposed on a portion of the current blocking layer that corresponds to the phase conversion area.

5 12. The semiconductor optical device as claimed in claim 1, wherein the semiconductor optical amplifier includes a buried hetero-structure semiconductor optical amplifier.

13. The semiconductor optical device of claim 12, further including a current
10 blocking layer.

14. A method of fabricating a semiconductor optical amplifier having a photo detector, the method comprising the steps of:

(a) forming a Bragg lattice on a portion of a first conductive semiconductor
15 substrate except for a predetermined gain layer area and a predetermined photo detector area;

(b) forming a first conductive lower clad layer, an optical waveguide layer, a first conductive upper clad layer, a gain material layer, and a second conductive clad layer on the first conductive semiconductor substrate on which the Bragg lattice is formed;

20 (c) forming mask patterns on portions of the second conductive clad layer which correspond to the predetermined gain layer area and on areas spaced horizontally by a predetermined distance respectively from a front end and a rear end of the predetermined

gain layer area;

(d) selectively etching the second conductive clad layer and the gain material layer through an etching process using the mask patterns as an etching mask, and then removing the mask patterns;

5 (e) forming a current blocking layer for preventing current from flowing to any area except the gain layer; and

(f) forming an electrode for supplying current to the gain layer and the photo detector area.

10 15. The method as claimed in claim 14, wherein, in step (a), the Bragg lattice is formed on a portion of the semiconductor substrate except for the predetermined gain layer area, the predetermined photo detector area, and a predetermined phase conversion area.

15 16. The method as claimed in claim 15, wherein, step (f) further includes a step of forming electrodes for supplying current to the gain layer area, the photo detector area, and the phase conversion area.

20 17. The method as claimed in claim 14, further comprising the step of integrating the semiconductor optical amplifier onto a single crystal semiconductor substrate without performing a separate photo detector growing process.

18. A method of fabricating a semiconductor optical amplifier having a photo detector, the method comprising the steps of:

(a) forming a gain material layer and a second conductive lower clad layer on a first conductive semiconductor substrate;

5 (b) forming mask patterns on portions of the second conductive lower clad layer corresponding to a predetermined gain layer area and a predetermined photo detector area, and selectively removing the second conductive lower clad layer, the gain material layer, and the semiconductor substrate through an etching process using the mask patterns as an etching mask, thereby forming a gain layer of a mesa structure, an active layer of a photo
10 detector, and an etching groove;

(c) forming a current blocking layer at the etching groove;

(d) forming an optical waveguide layer including a material having a refractive index higher than that of the semiconductor substrate on the current blocking layer;

(e) forming a Bragg lattice on the optical waveguide layer;

15 (f) forming a second conductive upper clad layer on an entire upper surface of a resultant structure on which the Bragg lattice is formed; and

(g) forming electrodes for supplying current to the gain layer and the active layer of the photo detector, respectively.

20 19. The method as claimed in claim 18, wherein, in step (e), a predetermined portion of the Bragg lattice layer has no Bragg lattice so as to form a phase conversion area thereto.

20. The method as claimed in claim 19, wherein, in step (g), a first, a second, and a third electrode for supplying current to the gain layer, the active layer of the photo detector, and the phase conversion area are formed.